

Once-Through Cooling Phase-Out

The Clean Water Act requires the U.S. Environmental Protection Agency to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts. Since 1972, states have enforced this requirement on a case-by-case basis in the absence of a specific federal rule. California parties expressed concerns that federal regulations were inadequate and should be addressed by a clearer, more prescriptive California rule.

The State Water Resources Control Board (SWRCB) first described a California regulatory approach in March 2008 when it published a scoping document titled *Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling* to implement Section 316(b) of the Clean Water Act, 33 U.S.C. § 1326(b).

The California Independent System Operator (California ISO) and five state agencies (California Energy Commission [CEC], California Public Utilities Commission [CPUC], California Coastal Commission [CCC], State Lands Commission [SLC], and California Air Resources Board [CARB]) worked closely with the SWRCB to develop a policy to achieve water quality goals while ensuring electricity grid reliability.

On May 4, 2010, the SWRCB approved a once-through cooling (OTC) policy that included many grid reliability recommendations made by the California ISO, as well as a joint implementation proposal developed by the Energy Commission, CPUC, and California ISO. The Office of Administrative Law approved the policy on September 27, 2010, and it became an effective regulation on October 1, 2010.

The regulation affected 19 power plants in California. Of those, 16 power plants totaling about 17,500 megawatts (MW) are in the California ISO balancing authority area, and three are in the Los Angeles Department of Water & Power (LADWP) balancing area. The original regulatory compliance dates range from 2010 to 2024. In July 2011, LADWP obtained the SWRCB's consent to delay compliance for its three units until 2029.

The policy recognizes that some of these plants are critical for system and local reliability. Some may also provide operational services (such as ramping to follow net load, regulation, and load following) needed to integrate renewable resources. Owners that plan to repower their facilities face additional regulatory challenges due to the lack of air credits required for new facilities or major changes to existing facilities in one or more of the air basins. To assure effective communication among the state's energy and environmental agencies concerning the role of these facilities in ensuring reliability, the OTC policy created a permanent advisory body – the Statewide Advisory Committee on Cooling Water Intake Structures (SACCWIS) – that is scheduled to report annually to the SWRCB. Recognizing the unique circumstances of the two nuclear facilities in California using OTC technologies, the OTC policy also established a second advisory body – the Review Committee for Nuclear Fueled Power Plants (RCNFPP) – to refine the cost estimates for the nuclear facilities to satisfy the policy.

OTC Phase-Out Status Tracks

The OTC policy determined that closed-cycle evaporative cooling was the best available technology and established this as a benchmark for two compliance tracks.

Track 1: Reduction of intake flow rate at each power-generating unit to a level that can be attained with a closed-cycle evaporative cooling system.¹ A minimum of 93 percent reduction is required compared to the design intake flow rate.

Track 2: If compliance with Track 1 is not feasible, the impingement mortality and entrainment² for the facility as a whole must be reduced to a comparable level to Track 1, using operational or structural controls, or both.

Alternatively, a plant can comply by shutting down.

Status of OTC Facility Compliance

The owners of each facility were required to submit an implementation plan by April 1, 2011. In these plans the owners indicated whether they proposed to follow Track 1, Track 2, or shut down. SWRCB staff, with assistance from the technical staff of the SACCWIS agencies, submitted letters seeking clarifications of the original implementation plans and, in some cases, sought further clarification as new issues surfaced. As a general rule, the owners of fossil generating facilities have abandoned plans to pursue Track 2 and have announced retirement plans. In January 2012, the San Onofre Nuclear Generating Station (San Onofre) was shut down for steam generator tube leaks, which the owners later determined to be too costly to repair. Southern California Edison announced San Onofre's permanent retirement on June 7, 2013.

The information shown in **Table 1** is from the original April 2011 filings of owner implementation plans and any subsequent revisions, if applicable. This table shows each facility and unit, the existing net qualifying capacity (NQC),³ the mandated compliance date, and the owner-

1 *Closed-cycle evaporative cooling system* refers to a cooling system that transfers waste heat to the surrounding air through the evaporation of water, thus enabling the reuse of a smaller amount of water several times to achieve the desired cooling effect. The only discharge of wastewater is from periodic blow-down to limit the buildup of materials in excess of desirable limits by best engineering practice.

2 Most facilities that obtain cooling water from surface water sources use some method of primary screening to prevent large objects from being drawn through the cooling system, where they may clog or damage sensitive equipment. These screens typically have mesh panels with slot sizes ranging from 3/8 inch to 1 inch and are rotated periodically or removed to clean off any debris, including aquatic organisms. *Impingement* occurs when organisms are trapped against the screen as a result of the force of the intake water and are unable to escape. *Entrainment* is the action of drawing smaller objects through the entire cooling water system, including the pumps and condenser tubes, and discharging them along with the cooling water and other plant wastes.

3 Net Quality Capacity is the concept used to describe the capacity from each resource that can be used by a load serving entity to satisfy its overall obligation. Most technologies have a single value, such as dependable capacity, used year-round. Some technologies (wind and solar without backup) have monthly NQC values reflecting the variability in performance using historic data.

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proposed method and date of compliance. The status in **Table 1** is shaded **green** if the unit has already met its requirements through physical or operational upgrades or has retired, **yellow** if the owner compliance date is earlier than or equal to the SWRCB date irrespective of the owner's plans for replacement capacity, or **red** if the proposed compliance date is after the SWRCB date. The facilities are listed in order of the adopted (or amended) compliance dates.

Table 1: OTC Implementation Schedules – Adopted and Owner-Proposed

Facility & Units	NQC	SWRCB Compliance Date	Owner Proposed Compliance Method/ Date
Humboldt Bay 1, 2	135	31-Dec-10	Retired 30-Sept-10
Potrero 3	206	1-Oct-11	Retired 28-Feb-11
South Bay	296	31-Dec-11	Retired 12/31/2010
Haynes 5,6	535	31-Dec-13	Repowered as air cooled 01-Jun-13
El Segundo 3	335	31-Dec-15	Repowered as air cooled 27-Jul-13
El Segundo 4	335	31-Dec-15	Plans to comply on 31-Dec-15
Morro Bay 3, 4	650	31-Dec-15	Plans to close facility on 02/28/2014
Scattergood 3	450	31-Dec-15	Repowering as air cooled in progress
Encina 1,2,3,4,5	946	31-Dec-17	Plans to comply on 31-Dec-17
Contra Costa 6, 7	674	31-Dec-17	Retired 30-April-13 ⁴
Pittsburg 5,6,7	1,307	31-Dec-17	Plans to comply on 31-Dec-17 ⁵
Moss Landing 1,2	1,020	31-Dec-17	Plans to implement Track 2 for CCGTs
Moss Landing 6,7	1,510	31-Dec-17	Plans to implement Track 2 by 31-Dec-17
Huntington Beach 1,2	452	31-Dec-20	Plans to repower by 31-Dec-22
Huntington Beach 3,4	452	31-Dec-20	Retired 01-Nov-12
Redondo 5,7	354	31-Dec-20	Plans to comply by 31-Dec-20
Redondo 6,8	989	31-Dec-20	Plans to retire by 31-Dec-18 to allow Huntington Beach 1-2 to be licensed
Alamitos 1,2	350	31-Dec-20	Requests delay to 31-Dec-27
Alamitos 3,4	668	31-Dec-20	Requests delay to 31-Dec-23
Alamitos 5,6	993	31-Dec-20	Plans to comply on 31-Dec-19
Mandalay 1,2	430	31-Dec-20	Plans to comply on 31-Dec-20
Ormond Beach 1,2	1,516	31-Dec-20	Plans to comply on 31-Dec-20
San Onofre 2,3	2,246	31-Dec-22	Retired 31-Jan-11 ⁶
Scattergood 1,2	367	31-Dec-24	Plans to repower by 31-Dec-20
Diablo Canyon 1,2	2,240	31-Dec-24	Plans to comply on 31-Dec-24 ⁷
Haynes 1,2	444	31-Dec-26	Plans to repower by 31-Dec-26
Harbor 1, 2, 5	229	31-Dec-29	Plans to repower by 31-Dec-26 ⁸
Haynes 8 - 10	575	31-Dec-29	Plans to repower by 31-Dec-29

Source: California Energy Commission

4 Although NRG retired Contra Costa 6-7, the Marsh Landing facility was constructed immediately next to the retired facility.

5 Unit 7 (682 MW) cannot operate independent of Units 5-6.

6 Although both units at San Onofre ceased power generation by January 31, 2011, units at San Onofre continue to draw substantial amounts of ocean water to cool nuclear fuel rods and other "hot" equipment.

7 Diablo Canyon's OTC requirements may be affected by an upcoming study of mitigation options overseen by the SWRCB's Review Committee for Nuclear Fueled Power Plants.

8 Harbor 1-2, 5, and Haynes 8-10 are combined-cycle units. Although only the heat recovery steam generator uses OTC technology, it is unclear whether LADWP will repower just that portion or replace the combustion turbines.

Table 2 summarizes the OTC compliance by showing the amount of capacity that has been retired or repowered ahead of the SWRCB schedule, the amount that is complying according to schedule, and the amount for which the facility has requested delay.

Table 2: Summary of OTC Compliance Intentions

Retired	4,009
Repowered	870
<i>Subtotal</i>	<i>4,879</i>
Plans to retire	1,639
Plans to repower	2,065
Track 2 compliance	2,530
Will comply on schedule	8,121
<i>Subtotal</i>	<i>15,355</i>
Requests delays	1,470
Total	20,704

Source: California Energy Commission

The unit-specific information in Table 1 and the summary in Table 2 are subject to change for power plants located in the Los Angeles Basin and San Diego. These OTC facilities are directly affected by the early closure of San Onofre and the pressure it places on developing replacement resources to ensure reliability to a large portion of Southern California. The joint preliminary reliability plan⁹ for the Los Angeles Basin and San Diego prepared by the technical staff of the CPUC, Energy Commission, and California ISO calls out shifts in OTC compliance date as a contingency measure that may need to be implemented if primary measures turn out to be insufficient.

Figure 1 shows expected progress toward the goal of the OTC policy – reduction in the inflow of ocean and estuarine water for power plant cooling – assuming plants fully use cooling water inflows as designed.¹⁰ The two lines show the variance between the progress that would be made using the SWRCB policy versus the progress that would be made using the power plant owners' proposed dates noted in the April 2011 implementation plans or in subsequent information made available to interagency staff. The line reflecting owners' compliance plans is almost always below the line using the official compliance dates, meaning that water inflows are being reduced faster than the OTC policy requires. The retirement of some facilities, especially San Onofre, on dates earlier than those incorporated into the OTC policy itself is responsible for this good news. After 2022, the owners' schedules cause water inflow to exceed that which

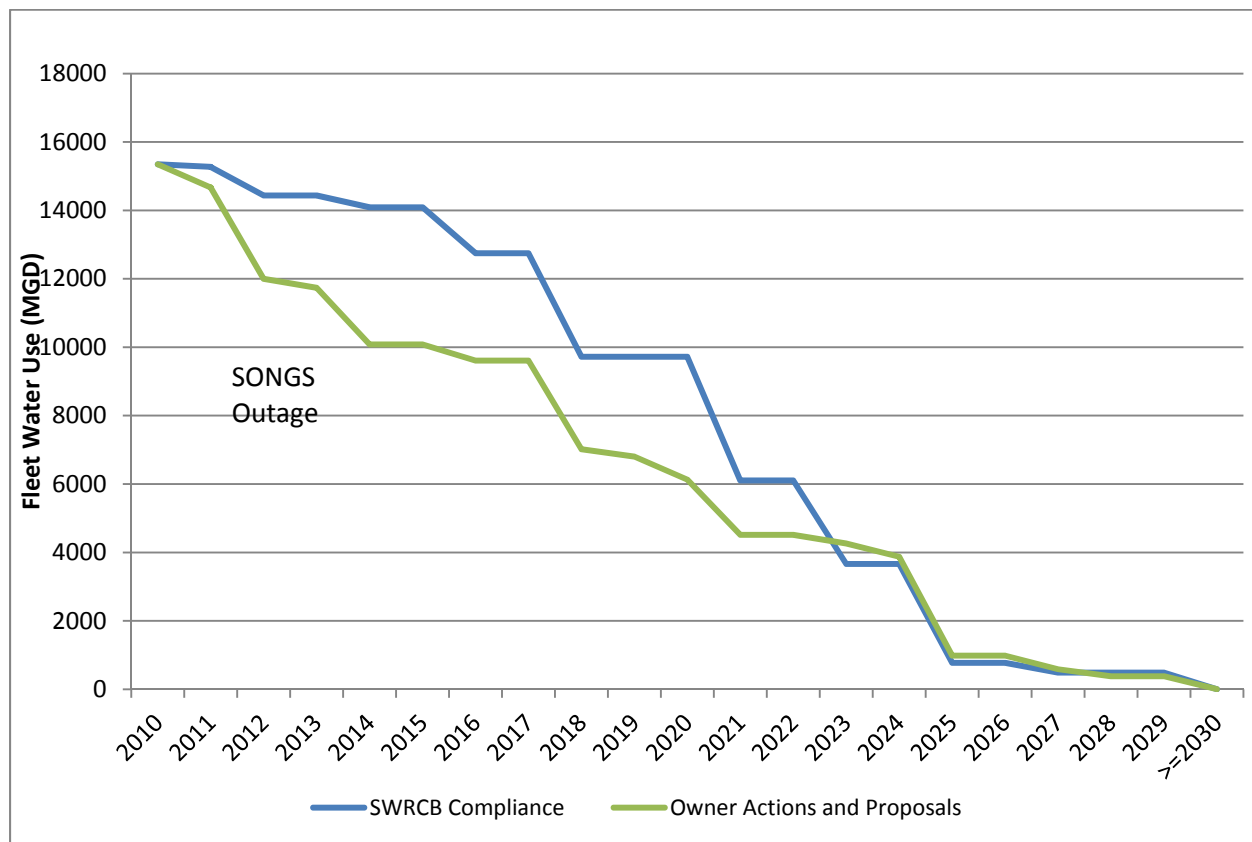
⁹ http://www.energy.ca.gov/2013_energypolicy/documents/2013-09-09_workshop/2013-08-30_prelim_plan.pdf.

¹⁰ Although most plants use less water in an actual operating year than expected under design conditions, data about actual water use are incomplete, and some available data appear to be inaccurate.

would be accomplished if the OTC policy were implemented as adopted. This is due to a limited extension for some Alamitos units.

Dates for Southern California units may be revised as a result of the process for examining Southern California reliability with the retirement of SONGS. The CPUC, Energy Commission, and California ISO staff put forward a preliminary reliability plan, and the Energy Commission conducted a workshop as part of the 2013 Integrated Energy Policy Report to review it.¹¹ No final decisions have been made.

Figure 1: Progress Toward OTC Policy Achievement



Source: California Energy Commission

Additional References:

http://www.swrcb.ca.gov/water_issues/programs/ocean/cwa316/docs/policy100110.pdf.

http://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/powerplants/.

¹¹ http://www.energy.ca.gov/2013_energy_policy/documents/#09092013.

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http://www.energy.ca.gov/2013_energy_policy/documents/2013-09-09_workshop/2013-08-30_prelim_plan.pdf.

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Next Update:

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